



**US Army Corps  
of Engineers**



## **Use of Gas Pipeline for Swim Area Barrier Float Line**

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### **Purpose**

This technical note provides information regarding the use of plastic gas pipeline to delineate areas designated for swimming. Use of gas pipeline for this purpose at Hartwell Lake has confirmed the durability, low maintenance, and high functionality of this product.

### **Background**

Innovations in the use of gas pipeline for applications in other than the intended use and design have resulted in benefits to the recreational community. Specifically, managers who provide water-related recreational opportunities are choosing gas pipeline as the preferred material for delineating swimming areas. This application is proving to be a more durable, safe, and user-friendly system than the more traditional buoy lines constructed of rope or cable with barrier floats, which have been in use for decades.

Polyethylene gas pipeline possesses several characteristics that make it an excellent candidate for use as swim area barrier line. It is constructed of medium-density polyethylene and comes in various diameters and lengths. Branch saddle T-joints (tees), 45- and 90-deg elbow joints (ells), and end caps are also available. The most practical size for use around swim areas is 4-in. pipe in 40-ft lengths. The pipe can also be obtained in continuous-length coils of 250 ft or more. However, this form can be more difficult to manage without the proper equipment.

The 4-in. pipe has a wall thickness of 0.5 in. It is virtually indestructible and corrosion proof. It is highly buoyant once sealed; however, an open-ended section will sink if allowed to fill with water. The bright yellow color makes it highly visible, and its continuous smooth surface provides a safe environment for swimmers.

Pipe sections are easily joined (fused) using a fusion machine, which can be purchased, rented, or borrowed. A portable generator is required to power the machine. The local utility company can probably provide information on how to obtain the needed materials. Depending on



how much piping is needed, it may be more advantageous to deal directly with the distributor, as was the case for Hartwell Lake.

## Procedures

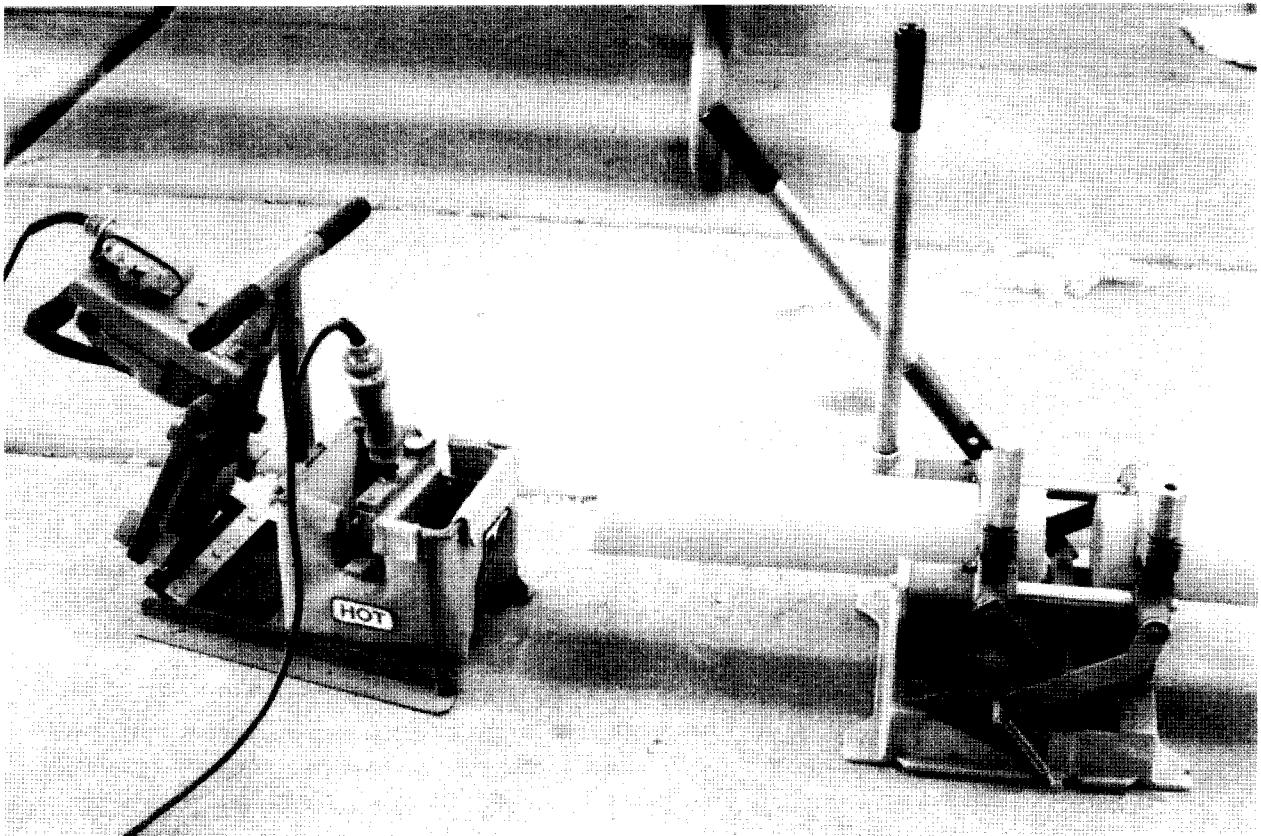
Installing a typical swim area float line is a fairly simple process. The butt end of pipes, ells, and end caps are fused together because there are no male or female ends. First, the pipe and required fittings (ells, caps, and tees) should be laid out on the beach/shoreline in the configuration desired (Figure 1). Any cuts can be easily made with a coarse-toothed handsaw.



**Figure 1. Pipeline sections and fittings (elbows, tees, and caps) can be arranged in the optimal configuration before assembly is begun**

The fusion machine consists of a combination pipe vise/press for aligning the pipe ends, a double-sided facing device (circular planer) for facing and squaring the pipe ends, and a double-sided heating iron for “melting” the pipe ends (Figure 2). The machine is moved around the assembly, fusing each joint in turn.

To begin the process, the end of each piece of pipe to be fused is locked into the pipe vise/press and carefully aligned. Next, the facing device is placed into position in the vise/press between the pipe ends, and the press is closed, bringing each pipe end into contact with the facing device. Each end is squared and faced simultaneously. The facing device is then removed, and the heating iron is positioned in the vise/press between the pipe ends. The press is closed, bringing the pipe ends into contact with the iron. The ends are allowed to head until a melt bead

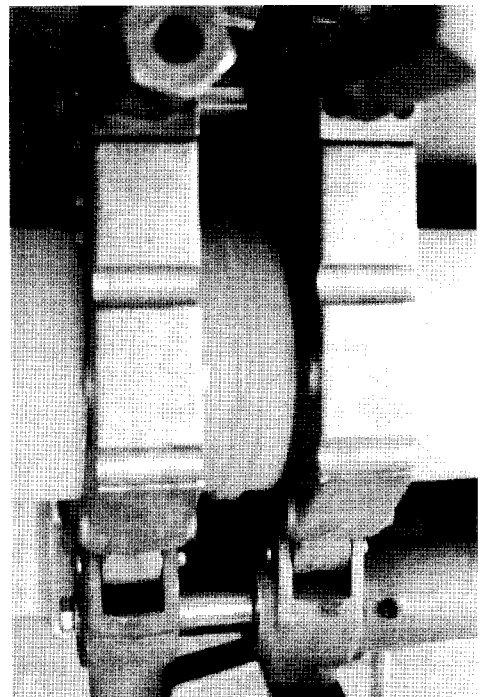


**Figure 2. Fusion equipment includes a heating iron and circular planer (left) and a combination pipe vise/press (right)**

of approximately one-eighth inch is achieved. To fuse the pipe, the press is opened, the heating iron is removed, the ends are checked for uniform melt (Figure 3), and the press is quickly closed (without slamming) and locked, forcing the melted ends together. Pressure is maintained until the joint has cooled to the touch.

The resulting fused joint is as strong as the pipe. The surface of the iron should be wiped off with a cotton cloth before proceeding to the next joint.

A slightly different process is used for fusing branch saddle tees to the sidewall of the main pipe. Saddle tees used at Hartwell Lake are referred to as 4 × 2 (in.) branch saddle tees. The traditional purpose of such tees (as used by gas pipeline companies) is to run a 2-in. branch line off the 4-in. main. Once fused to the main, a drill is normally inserted into the end of the tee and a hole is drilled through the main pipe. Additional 2-in. line is then fused to the tee as needed.



**Figure 3. A uniform melt ensures that the fused joint is as strong as the pipe**

For the purposes of this application, the tees allow the anchor cable to be attached. The tees are fused to the main pipeline at locations where anchor points are needed. A swivel is attached inside the open end of the tee by drilling a hole in the tee sidewall and running a stainless steel bolt with a lock nut through the tee and swivel. The pipeline can then be anchored by traditional means.

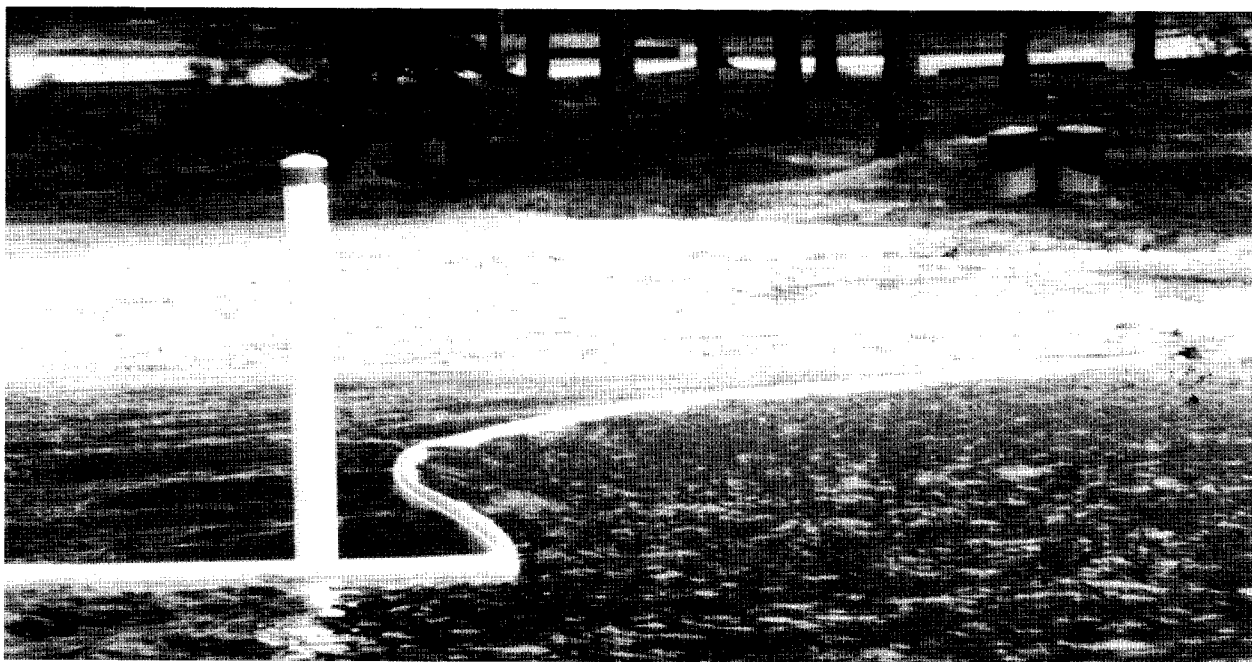
A separate fusion device is used for fusing branch saddle tees to the main pipeline. This device includes a tee vise and a double-sided tee heating iron. Except for a few minor differences, the same fusing process is used for branch saddle tees.

### Optional Details

The 4-in. pipe is first locked into the tee vise; the sidewall is cleaned, then roughed with 60-grit utility cloth. The base of the tee is also cleaned and roughed. Then, the tee is mounted in the vise, and the tee heating iron is positioned between the pipe and tee. The vise is closed and pressure (60 psi) is applied; the pipe sidewall and tee base are heated as previously described.

After a melt bead approximately one-eighth to one-fourth inch has formed, the vise is opened and the iron is removed. The vise is quickly closed (without slamming), forcing the melted tee base onto the melted sidewall. The tee vise is equipped with a pressure gauge and threaded feed rod. The threaded feed rod is constantly adjusted to ensure that proper pressure is maintained until the pipe has cooled to the touch.

The final step before launching the new swim line is to ensure that end caps have been fused to each end to prevent water from entering and sinking the line. After construction is complete, the line is pushed, dragged, or towed by boat into place and anchored. The pipe is highly flexible (Figure 4), and wind and wave action can cause bows in the line. The number and location of anchor points will depend upon size, configuration, and severity of exposure to wind and waves.

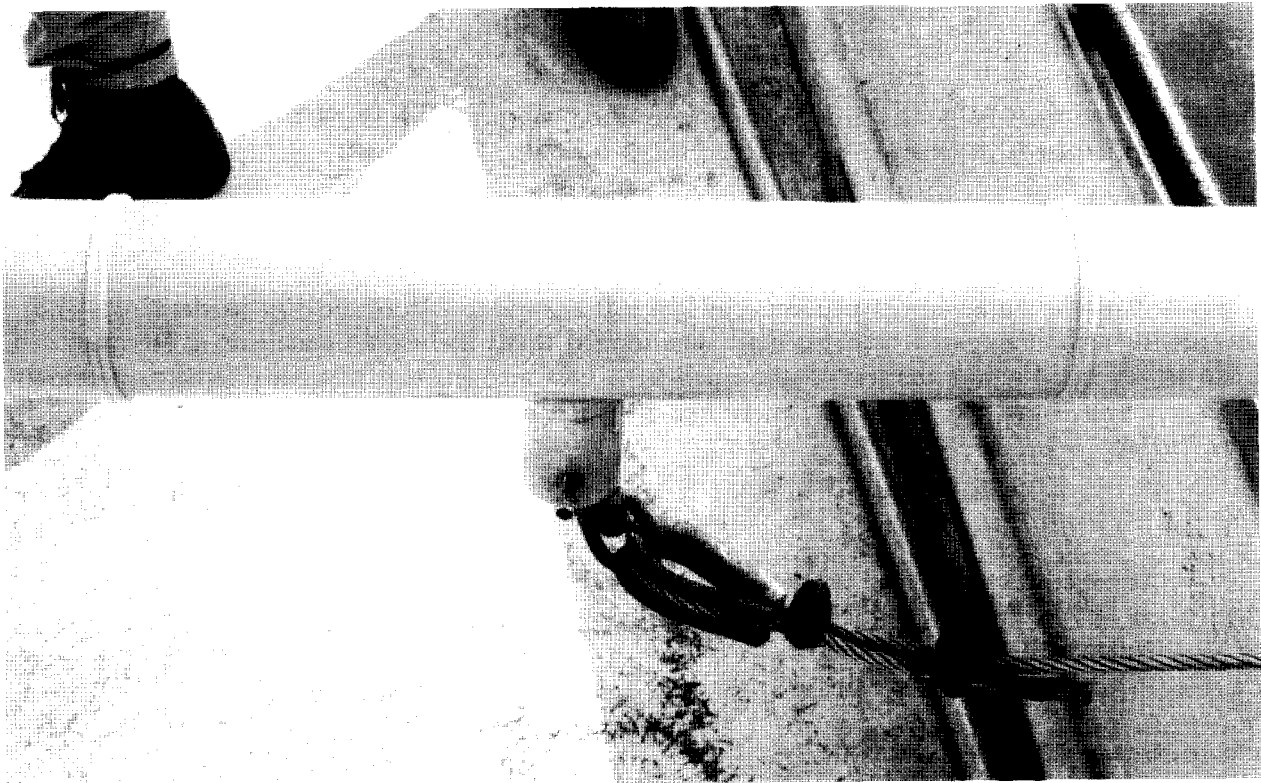


**Figure 4. Polyethylene gas pipeline is highly flexible, a significant advantage for use as swim barrier line**

## Additional Tips

Waiting for a fused joint to cool can be the longest step in the process, especially on a hot, sunny day. The pipe manufacturer does not recommend that water be used to speed the cooling process. However, after 1 year in place, the pipe swim lines at Hartwell Lake have apparently suffered no damage as a result of taking this risk.

By design, the tee vise fuses the tees to the main pipe from the top. However, anchor cables are normally attached to the bottom of swim lines. To resolve this, anchor points can be made up in advance by cutting several short sections of pipe (2 to 3 ft long) and fusing a tee to each piece (Figure 5). Once a supply of anchor points has been prepared, the individual points can be laid out and incorporated into the initial configuration. As joints are fused, the anchor pieces can be turned so that each branch saddle tee faces downward. This will result in a properly oriented anchor point with very little difficulty.



**Figure 5. Sections of pipe with cable anchor attached to branch saddle tee can be prepared in advance, and later incorporated into barrier line configurations as needed**

An additional advantage of this method is that, because the tee vise with iron is a separate device from the 4-in. pipe fusion machine, anchor points can be made up in a day's time, thus limiting the amount of time the tee vise and iron are needed. As a result, it might be possible to borrow or rent the tee vise for a day, rather than having to purchase one.

## Traditional Barrier Float Lines

Twenty-one designated swimming beaches are maintained at Hartwell Lake. Historically, each beach has been delineated with a conventional cable and barrier float system. At last count, the total system required 579 individual barrier floats and more than 7,160 ft of cable.

Maintaining such a system is no easy chore. In 1994, an inspection revealed that 245 barrier floats were "bad." (This designation was given to floats with cracks  $\geq 2$  in.)

Two float types (25- and 8-lb barrier floats) have been used, and each type is mounted to the cable by different means. The 25-lb float was preferred, since it was designed to be clamped to the cable on one end. Floats of this type could be easily removed and replaced. The 8-lb variety had a steel sleeve through its center. The float was attached to the cable by feeding the cable through the sleeve and attaching cable clamps at either end to hold the float in place. To replace a float required cutting and splicing the cable, or removing and/or repositioning several floats, depending on how far down the line one was working.

Another problem has been to devise a safe method of securing the cable ends, to prevent swimmers from being injured on sharp edges or frayed portions of the cable. Severely damaged floats also presented safety hazards to swimmers from sharp jagged edges. Constant maintenance demanded the need for change.

## Cost Analysis

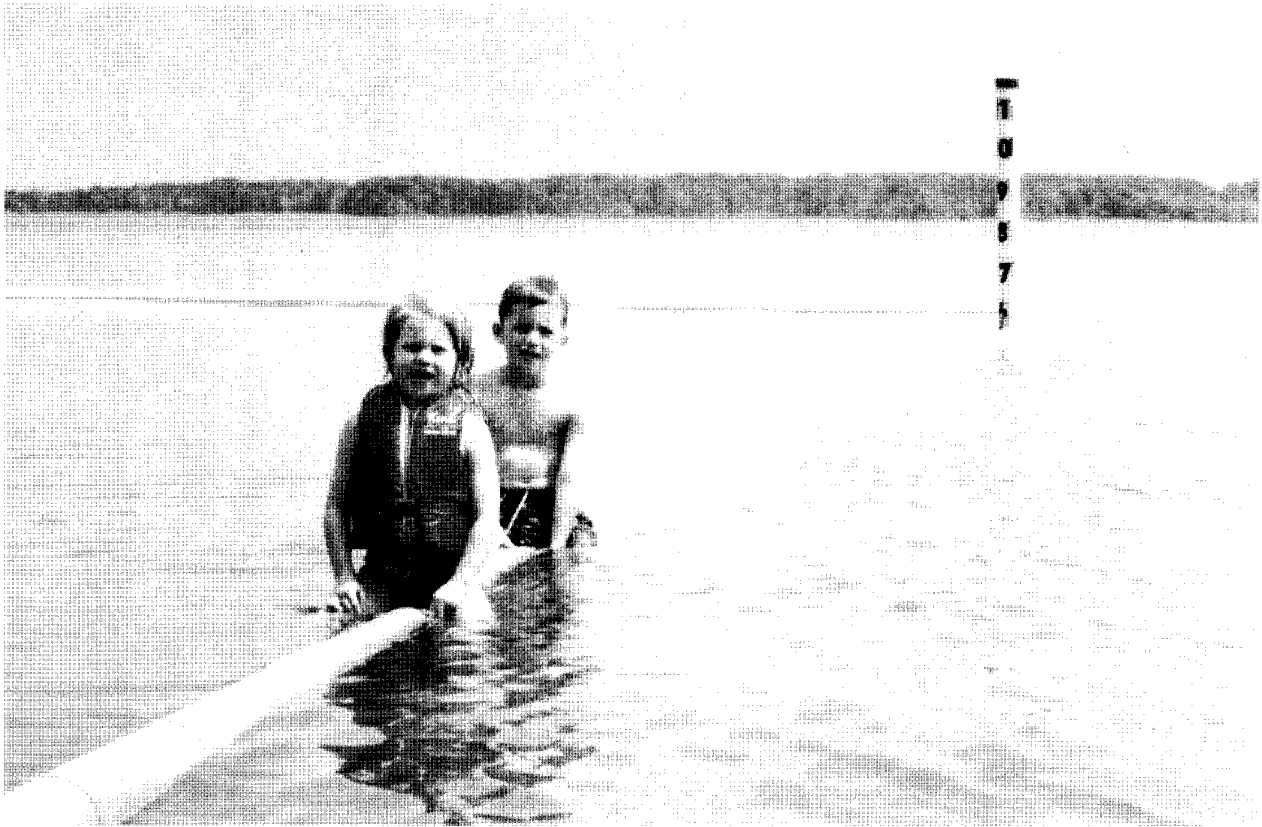
Faced with the immediate expenditure of \$24,500 to replace 245 of the 579 barrier floats and the additional future costs to replace other deteriorated floats and cable, managers at Hartwell Lake began investigating the use of gas pipeline. A cost analysis (see summary tabulation below) quickly revealed that the most efficient course of action was conversion to gas pipeline swim area barriers.

Current and Future Cost of Maintaining Traditional Swim Area Barrier <sup>1</sup>			Cost of Conversion to Gas Pipeline Swim Area Barrier		
Action/Materials	Unit Cost	Subtotal	Action/Materials	Unit Cost	Subtotal
Replace 579 floats/hardware	\$100.00 ea	\$57,900	Install polyethylene gas pipeline (7,160 ft)	\$ 1.90/ft	\$13,604
Replace float line cable (7,160 ft)	\$ 1.80/ft	\$12,888	Install 45-deg (20) and 90-deg (25) elbows	\$29.00 ea	\$ 1,305
			Install end caps (40)	\$18.50 ea	\$ 740
			Install branch saddle tees (100)	\$21.50 ea	\$ 2,150
			Purchase fusion machine	N/A	\$ 3,500
<b>Total</b>		<b>\$70,788</b>	<b>Total</b>		<b>\$21,299</b>

<sup>1</sup> Worst-case scenario (cost over long term to replace entire barrier system).

## Cost Savings

The swim area barriers at all 21 beaches at Hartwell Lake (Figure 6) were converted for less than the cost of replacing fewer than half the traditional barrier floats. Another significant benefit is that swim line maintenance costs at Hartwell Lake have been zero since the conversion, compared with the additional maintenance costs that undoubtedly would have been incurred to replace deteriorated floats and cable.



**Figure 6. Gas pipeline swim area barriers are safe, user friendly, and maintenance free**

## Summary

Utilizing gas pipeline to provide a distinctive, safe, user friendly, and maintenance-free barrier line around designated swimming areas is relatively simple and cost effective. The method is clearly becoming increasingly popular with both recreation managers and swimmers.

Future benefits in maintenance cost savings and the compatibility with swim area users make the use of gas pipeline a valuable choice.

## Point of Contact

This technical note was written by Mr. Scott Strotman, while serving as Construction Representative at Hartwell Lake, U.S. Army Engineer District, Savannah. For further information, contact Mr. Strotman at J. Strom Thurmond Lake, 1-800-533-3478, extension 1171, or Mr. Frank Huff of the Savannah District, (912) 652-5053.